

ENERGY CONSUMPTION ASSESSMENT

50 BUILDINGS REPORT

PRESENTATION TO LEADERSHIP TEAM

Christine Dennehy, Project Manager
Todd Isherwood, Energy Manager
Joseph LaRusso, Finance Manager
City of Boston

John Peterson
Bill Kosik
Hewlett Packard



Introduction

The energy consumption assessment was conducted to aid with evaluation of an Enterprise Energy Management System (EEMS).

The 50 Buildings & the Departments

- Administration (8 buildings)
- Public Safety (5 buildings)
- Library (2 buildings)
- Schools (35)
- City data sources

Building Assessment and Benchmarking

- Assessment data sources
- Building categories
- Energy units
- Benchmarking value

Assessments and Results

- Department energy consumption assessments – overviews and graphs
- Results summary
- Recommendations



The 50 Buildings

List of the top 50 by energy cost

- The selected buildings have the highest energy cost to the City

Reviewed over fiscal year 2011

- The review period for the energy use was from July 2010 to June 2011
- The data taken on a monthly cycle
- Electricity, natural gas, and steam consumption were reviewed

4 building departments

- Administration – 8 buildings
- Public Safety – 5 buildings
- Libraries – 2 buildings
- Schools – 35 buildings

Data sources

- City of Boston
 - Mass Energy Insight – utility billing and use
 - City Personnel – building information
- National Grid – natural gas
- NSTAR – electricity
- Boston Water and Sewer Commission – water



Building Assessment & Benchmarking

Assessment Data Sources - National Averages

- Consumer Buildings Energy Consumption Survey (CBECS) – comparisons for benchmarking buildings
- Building Owners and Managers Association (BOMA) – building energy consumption source

Building Categories

- The 50 buildings have been reviewed according to 4 main categories:
 - Size (square feet)
 - Primary building activity
 - Climate zone – Northeast
 - Other government buildings – Local Government

Energy Units

- Measurements by:
 - kilowatt-hour (kWh) – electricity
 - thousand British thermal units (kBtu) – natural gas & steam
- Units can be interchanged: 3.412 conversion factor

Benchmarking

- Provides a general magnitude of the opportunities available
- Helps determine which buildings to focus
- First step toward improving performance

Department Energy Consumption Assessment

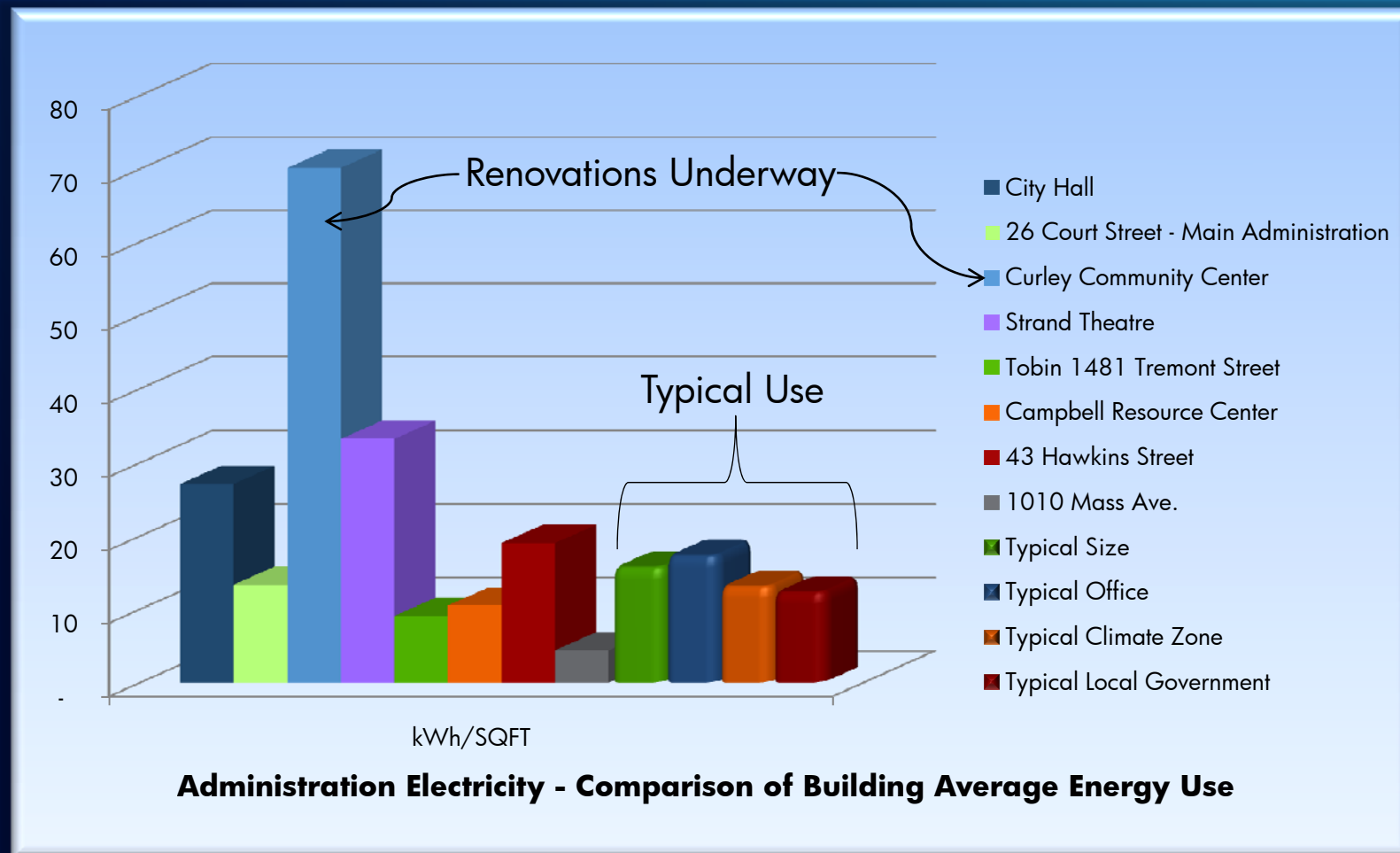
Administration – Overview

- 8 buildings reviewed
- Primarily office space
- Extended hours of services & operation
- City Hall uses steam; others use natural gas



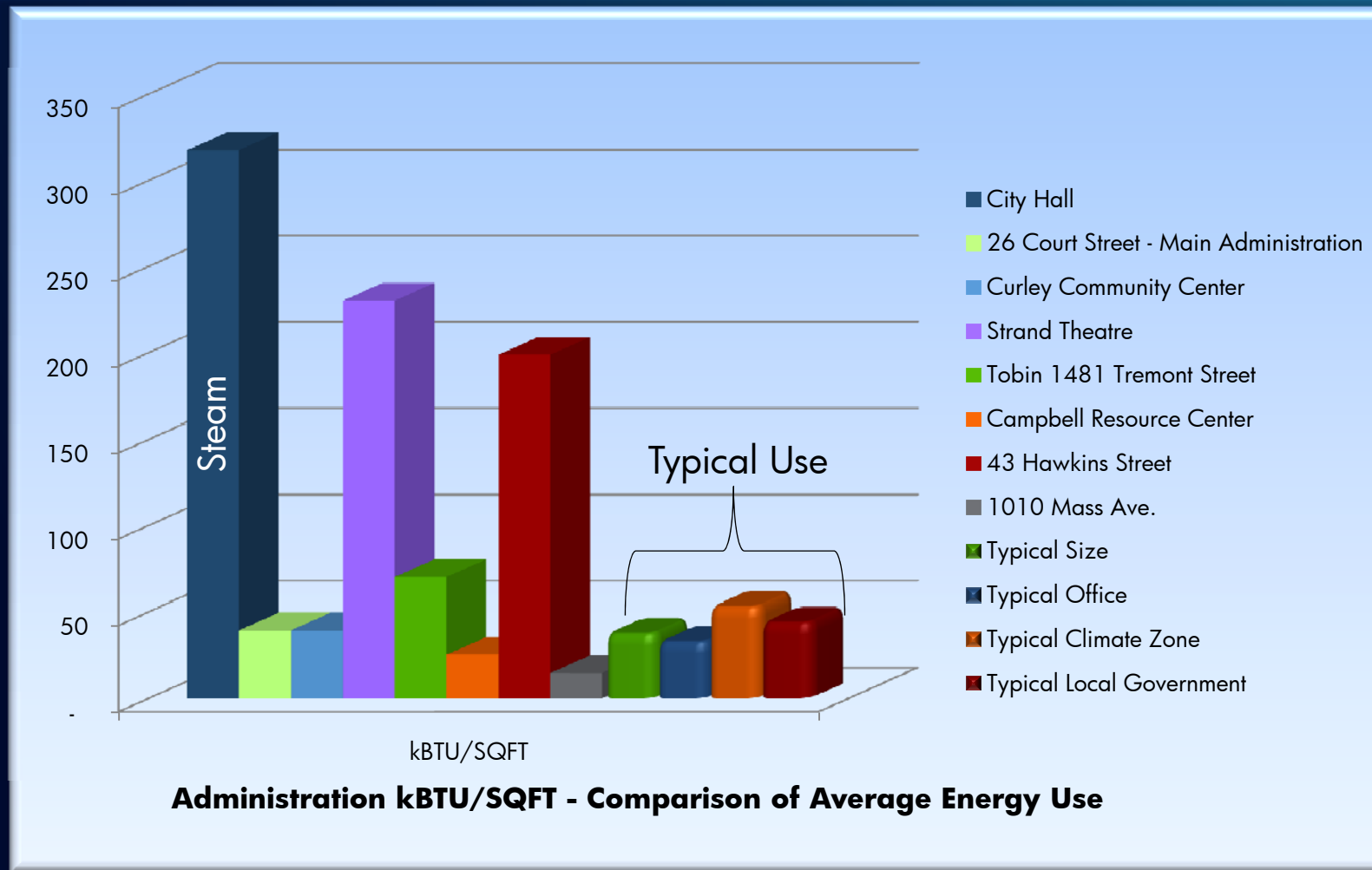
Department Energy Consumption Assessment

Administration – Electricity Use



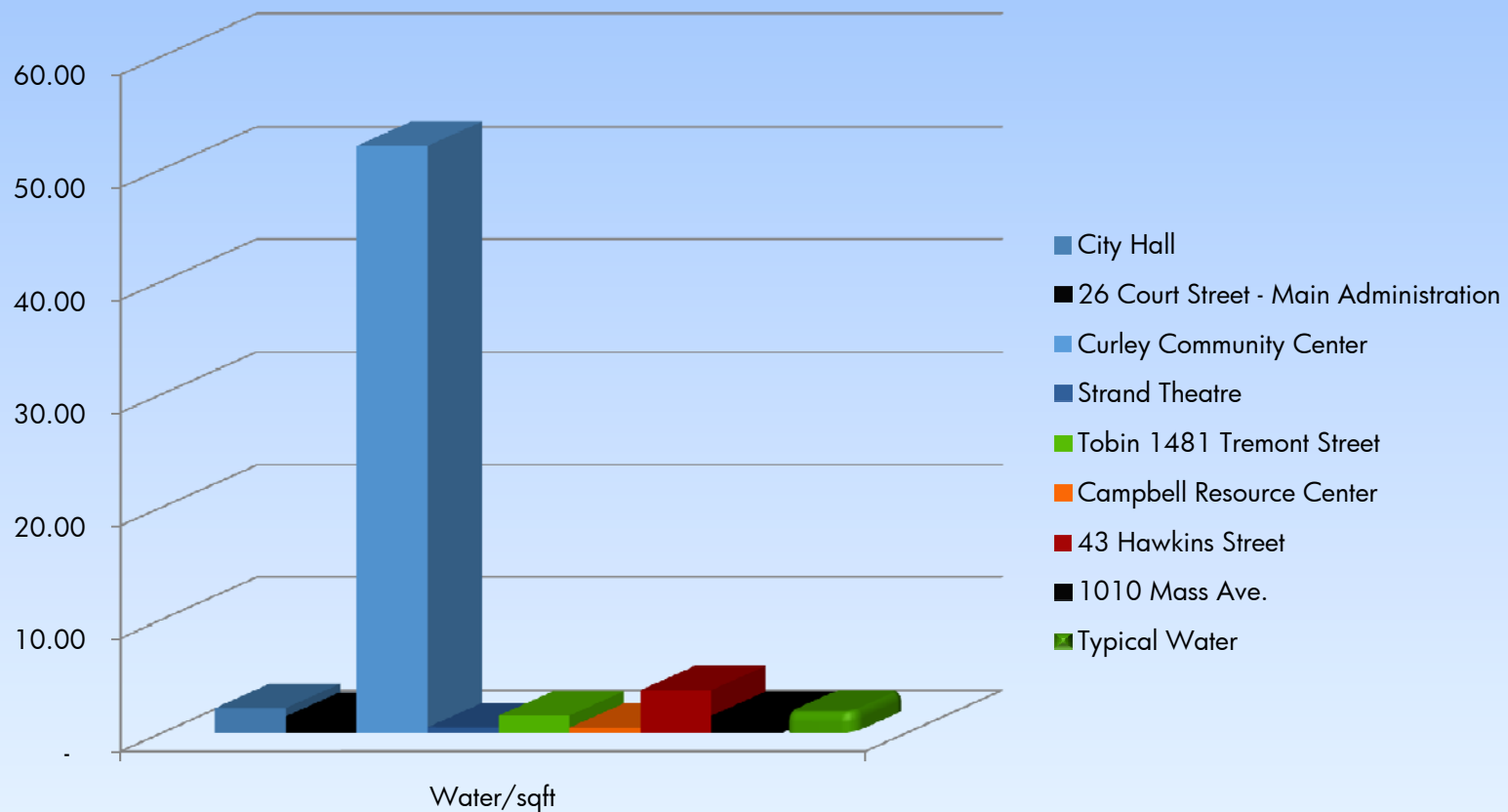
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Administration – Steam and Natural Gas Use



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Administration – Water Use



Administration Water Use - Comparison of Building Average Use

Department Energy Consumption Assessment

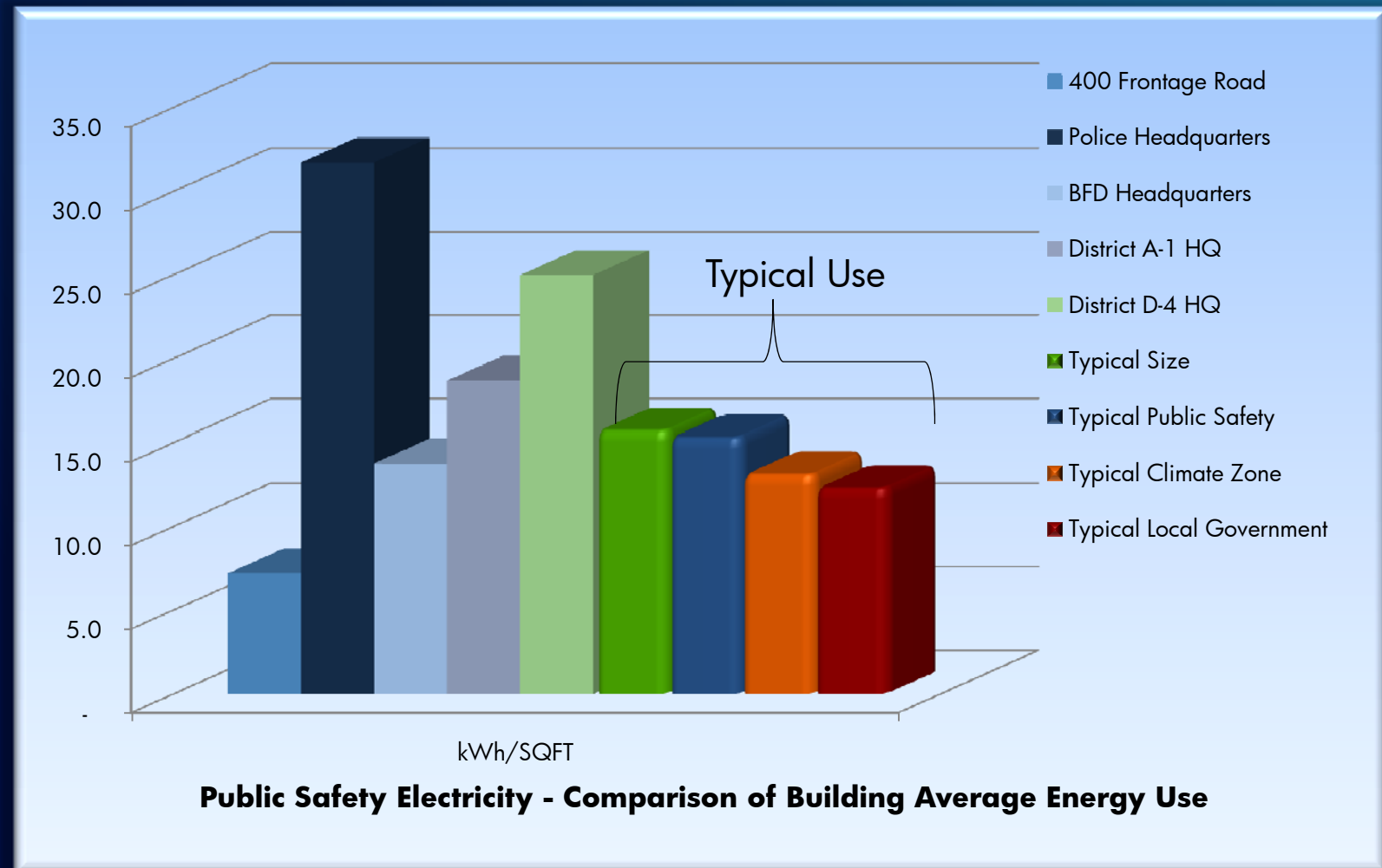
Public Safety – Overview

- 5 buildings reviewed
- Public Safety space – operations and maintenance are high priority
- Extended hours of services & operation
- All Public Safety buildings reviewed use natural gas
- All Public Safety buildings had higher than average natural gas consumption



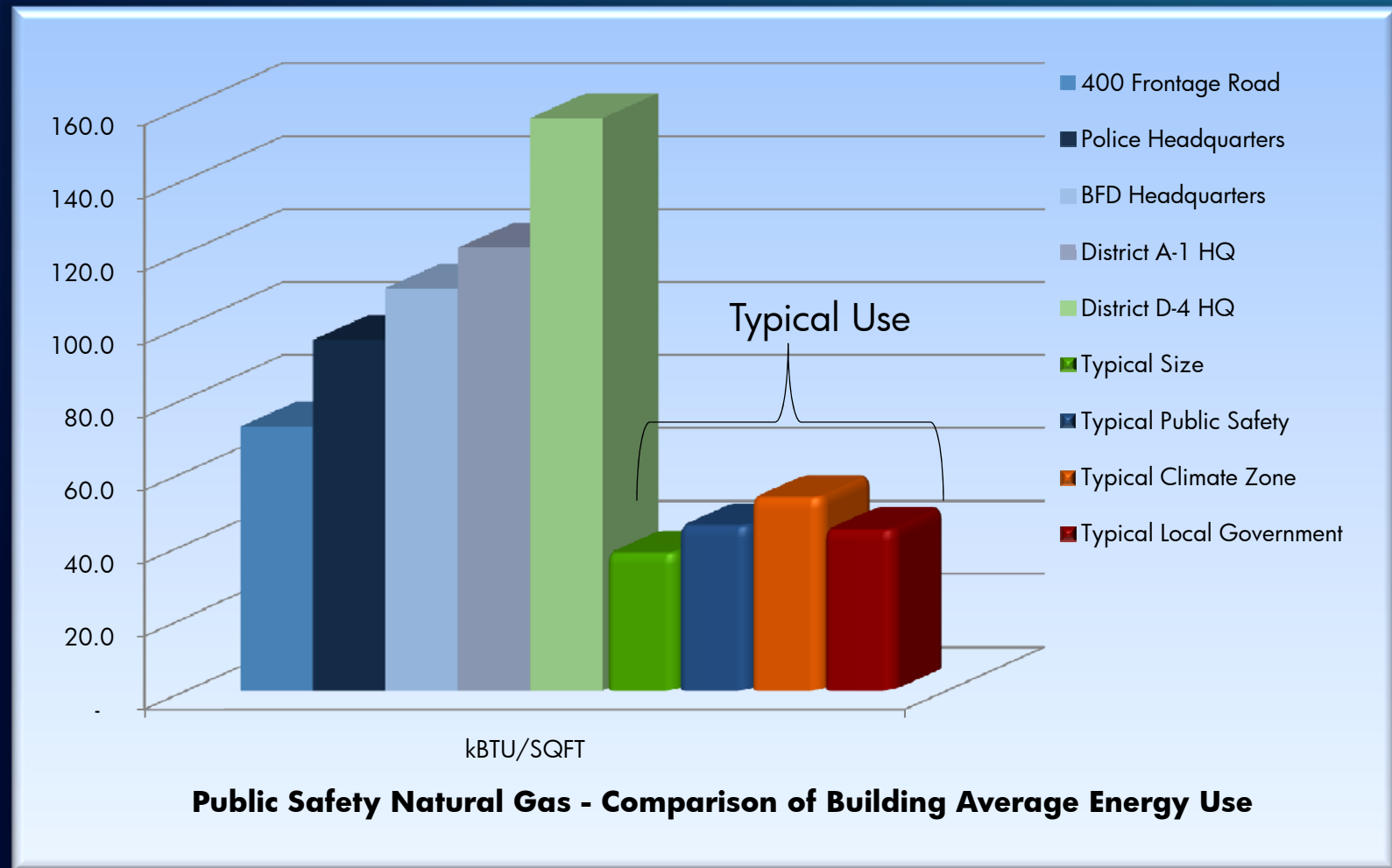
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Public Safety – Electricity Use



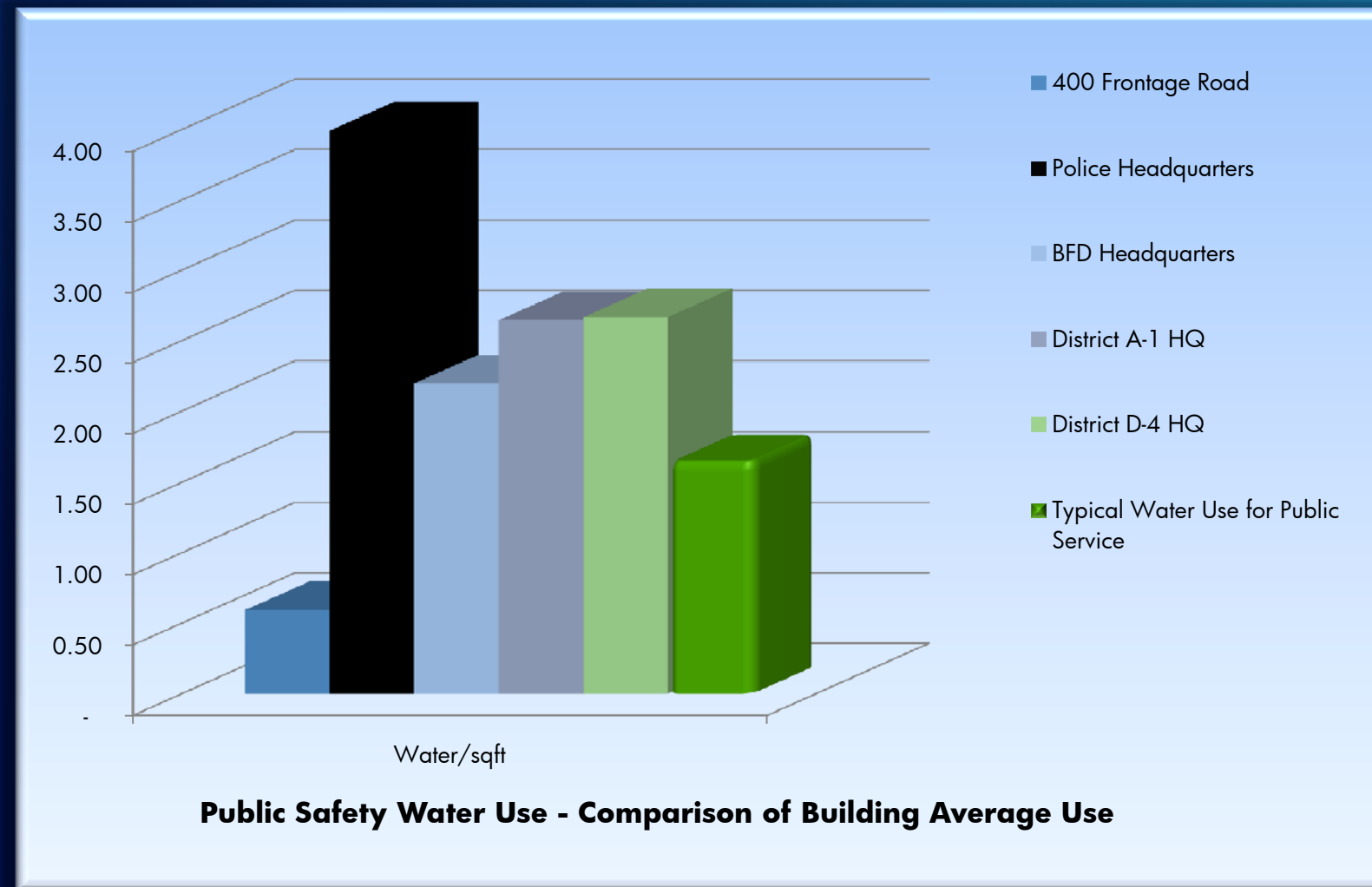
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Public Safety – Natural Gas Use



Department Energy Consumption Assessment

Public Safety – Water Use



Department Energy Consumption Assessment

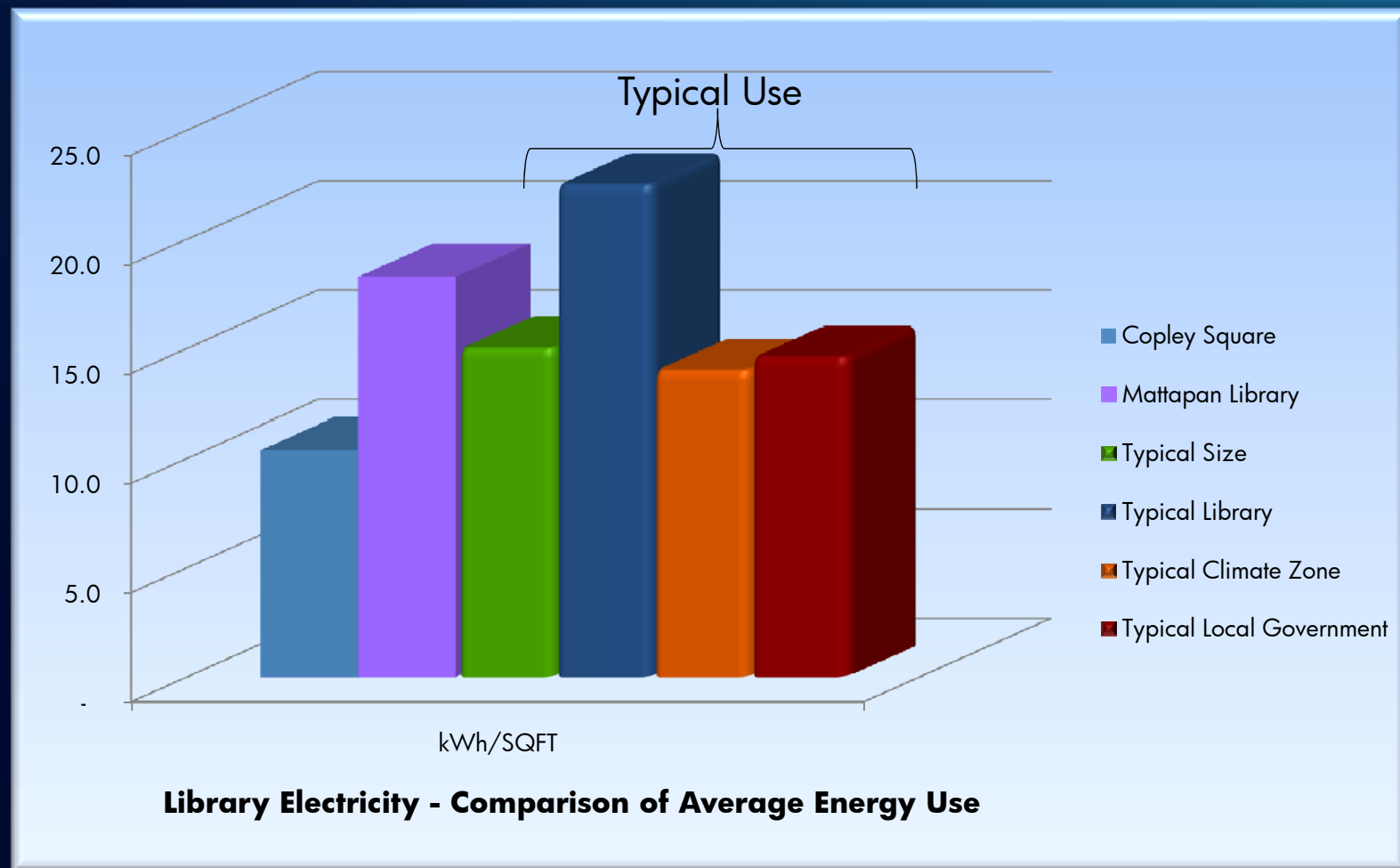
Library – Overview

- 2 buildings reviewed
- Library space – public occupancy and services
- Copley Library served by steam; Mattapan served by natural gas
- Despite differences in both age and size, the kBtu per square foot for both libraries is higher than average



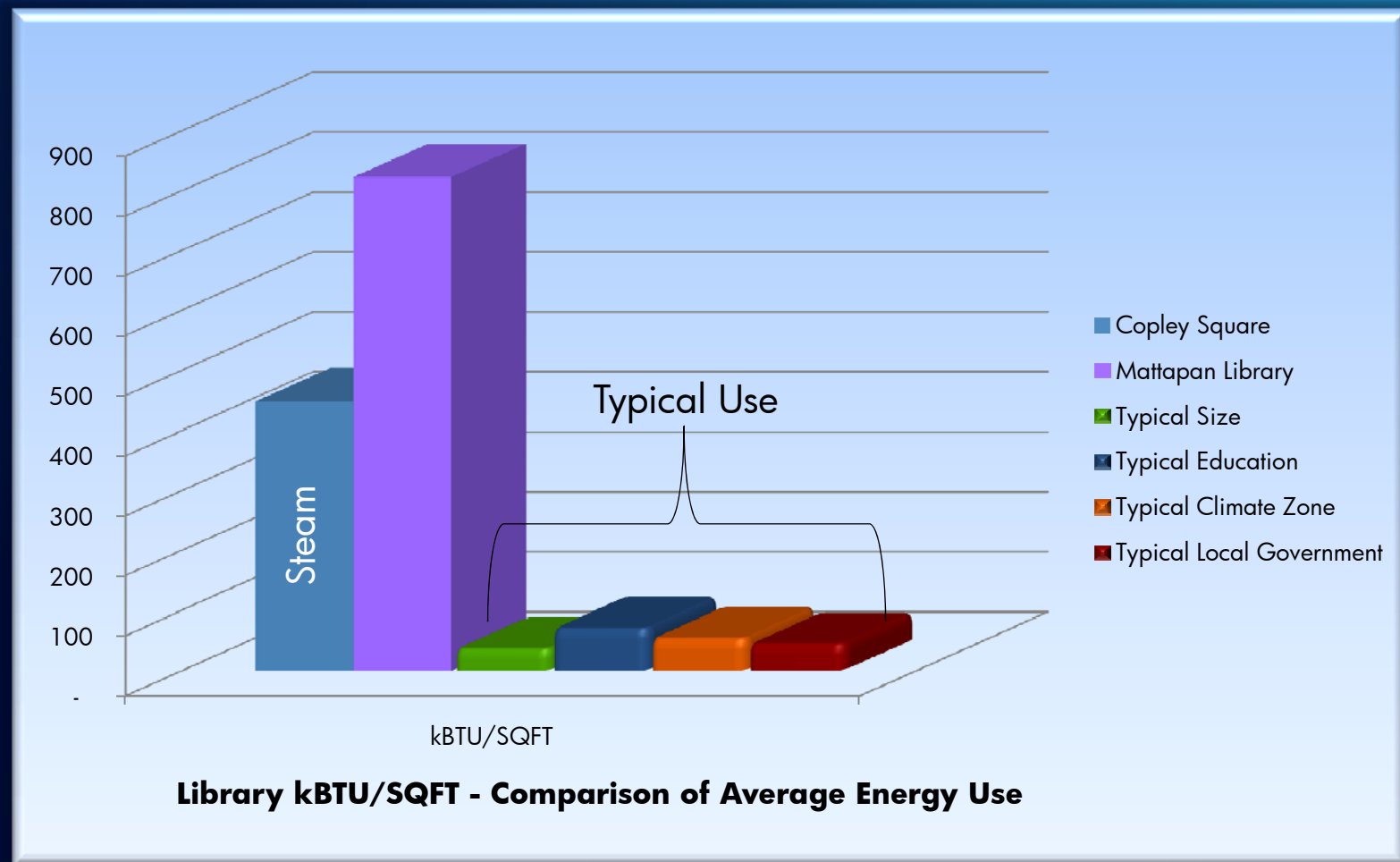
Department Energy Consumption Assessment

Library – Electricity Use



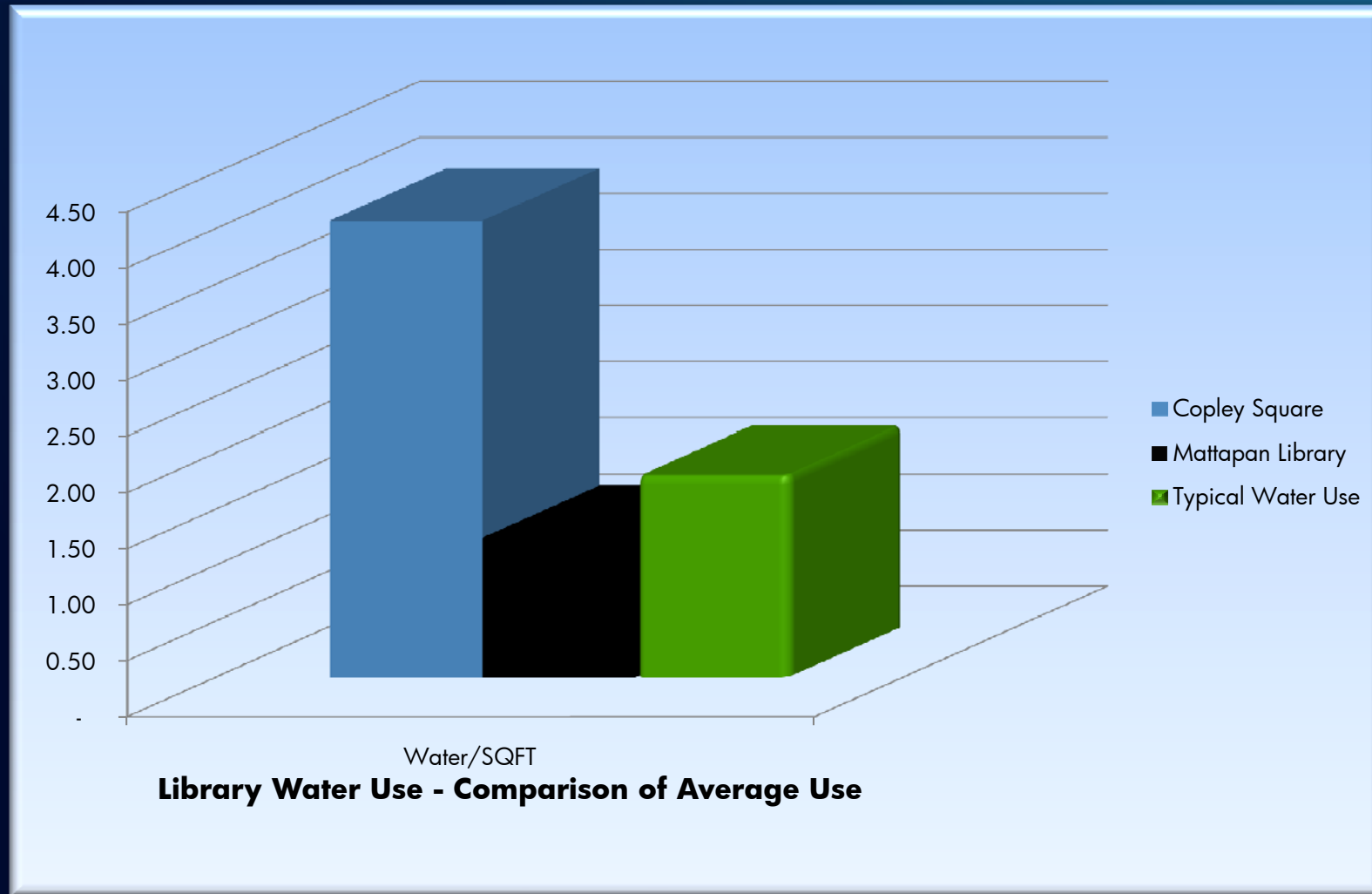
Department Energy Consumption Assessment

Library – Steam & Natural Gas Use



Department Energy Consumption Assessment

Library – Water Use



Department Energy Consumption Assessment

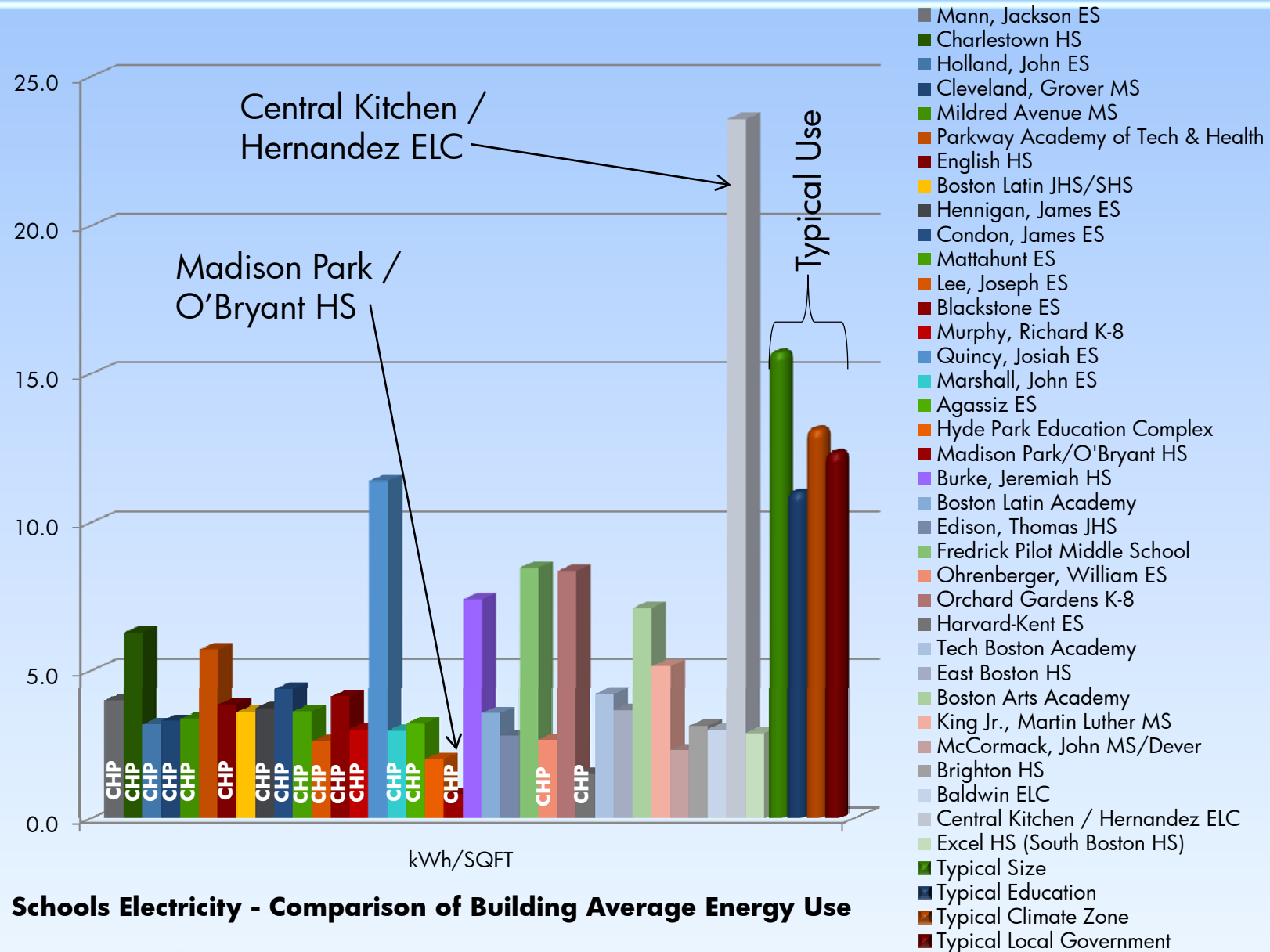
Schools – Overview

- 35 buildings reviewed
- School buildings – student occupancy provided
- 14 school buildings served by Combined Heat & Power (CHP) units
- Average summer use is low



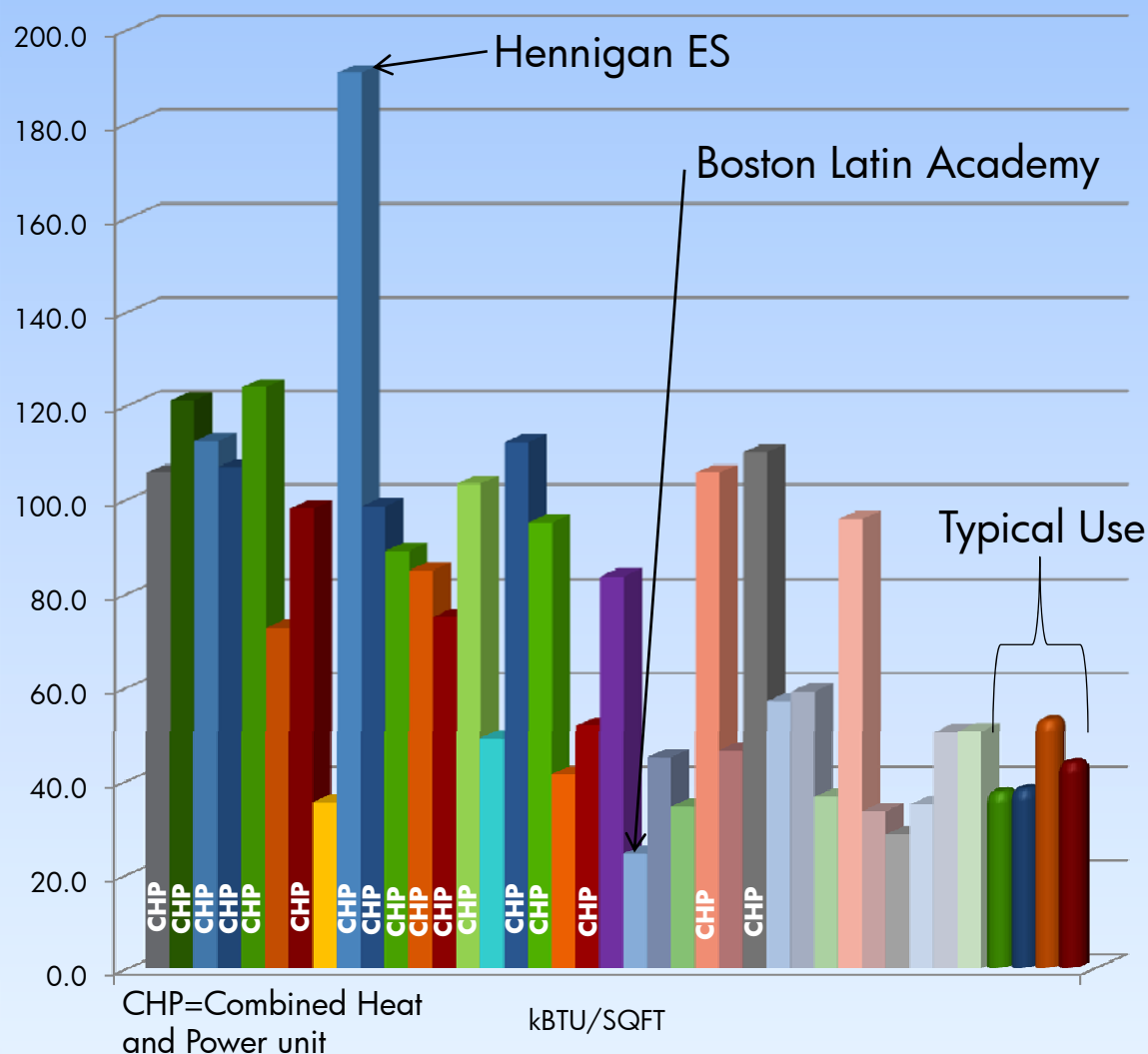
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Schools – Electricity Use



Department Energy Consumption Assessment

Schools – Natural Gas Use

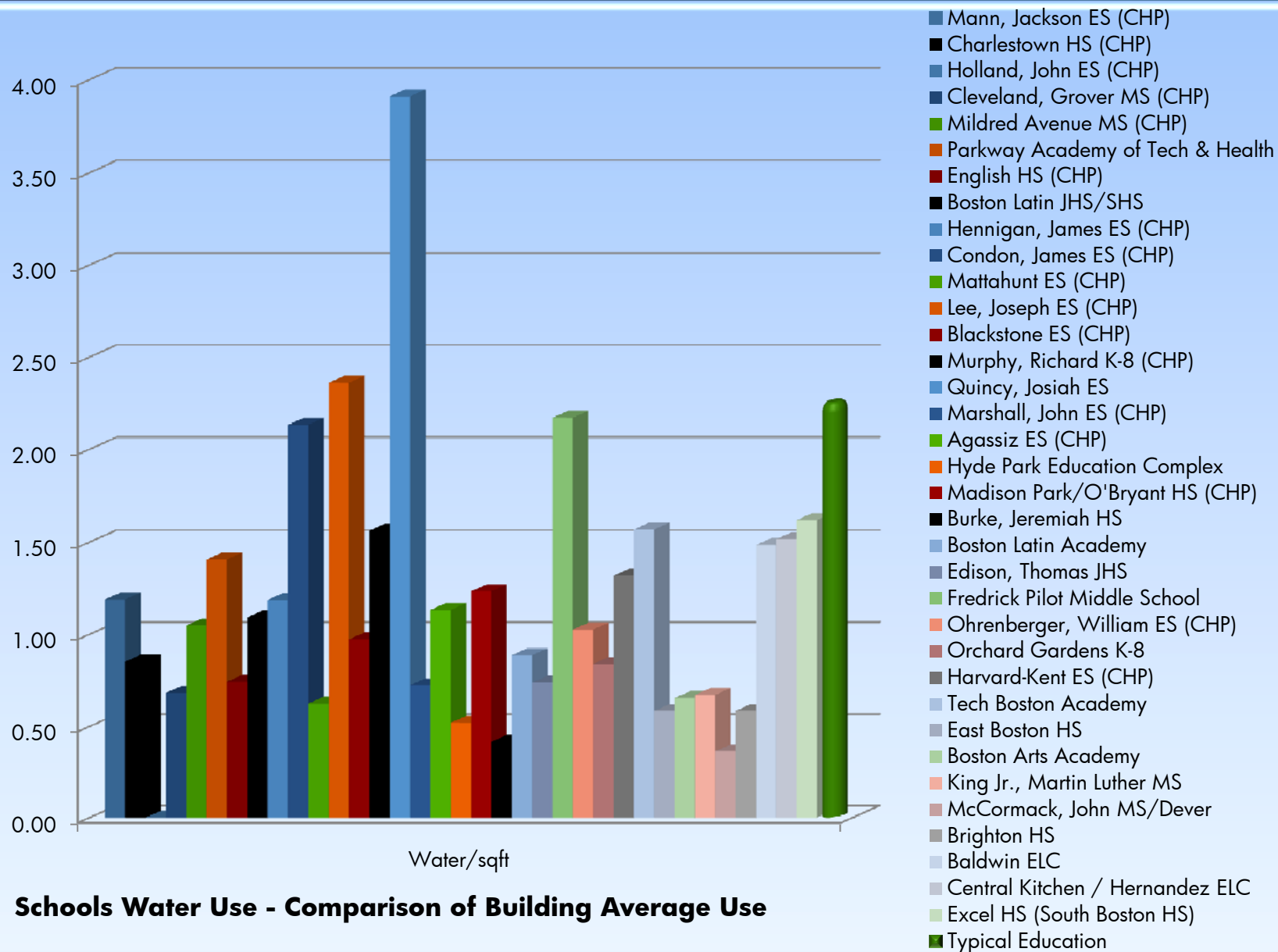


Schools Natural Gas - Comparison of Building Average Energy Use

- Mann, Jackson ES (CHP)
- Charlestown HS (CHP)
- Holland, John ES (CHP)
- Cleveland, Grover MS (CHP)
- Mildred Avenue MS (CHP)
- Parkway Academy of Tech & Health
- English HS (CHP)
- Boston Latin JHS/SHS
- Hennigan, James ES (CHP)
- Condon, James ES (CHP)
- Mattahunt ES (CHP)
- Lee, Joseph ES (CHP)
- Blackstone ES (CHP)
- Murphy, Richard K-8 (CHP)
- Quincy, Josiah ES
- Marshall, John ES (CHP)
- Agassiz ES (CHP)
- Hyde Park Education Complex
- Madison Park/O'Bryant HS (CHP)
- Burke, Jeremiah HS
- Boston Latin Academy
- Edison, Thomas JHS
- Fredrick Pilot Middle School
- Ohrenberger, William ES (CHP)
- Orchard Gardens K-8
- Harvard-Kent ES (CHP)
- Tech Boston Academy
- East Boston HS
- Boston Arts Academy
- King Jr., Martin Luther MS
- McCormack, John MS/Dever
- Brighton HS
- Baldwin ELC
- Central Kitchen / Hernandez ELC
- Excel HS (South Boston HS)
- Typical Size
- Typical Education
- Typical Climate Zone
- Typical Local Government

Department Energy Consumption Assessment

Schools – Water Use



Results Summary

- **Overall**

- The energy use per building exceeds the averages for region, size, primary use, and owner category
 - Examples of highest users per SQFT: City Hall, Copley Square, Mattapan Library, Strand Theater, 43 Hawkins Avenue.

- **Electricity**

- Most of the buildings within each of their categories exceeded all of their categorical averages for electrical consumption **or** offset the electricity use with natural gas (CHP)
- Since the energy cost for these buildings is also considered high, this was not unexpected

- **Natural Gas**

- 88% of the buildings that were evaluated exceeded even the highest kBTU/SQFT average
- This consumption was used primarily for heating
- School consumption also includes gas consumption to generate electricity

- **Water Use**

- Most of the buildings met or were lower than average
- Those that exceeded have additional water and sewer loads (swimming pools, etc.)
- Reduction of water use would also reduce sewer costs

Recommendations

- **Perform Building Audits**

- Detailed audits of the buildings should be performed to make more detailed observations and determinations for energy savings
- The American Society of Heating Refrigeration and Air-conditioning Engineers (ASHRAE) has developed audit levels based on different levels of depth

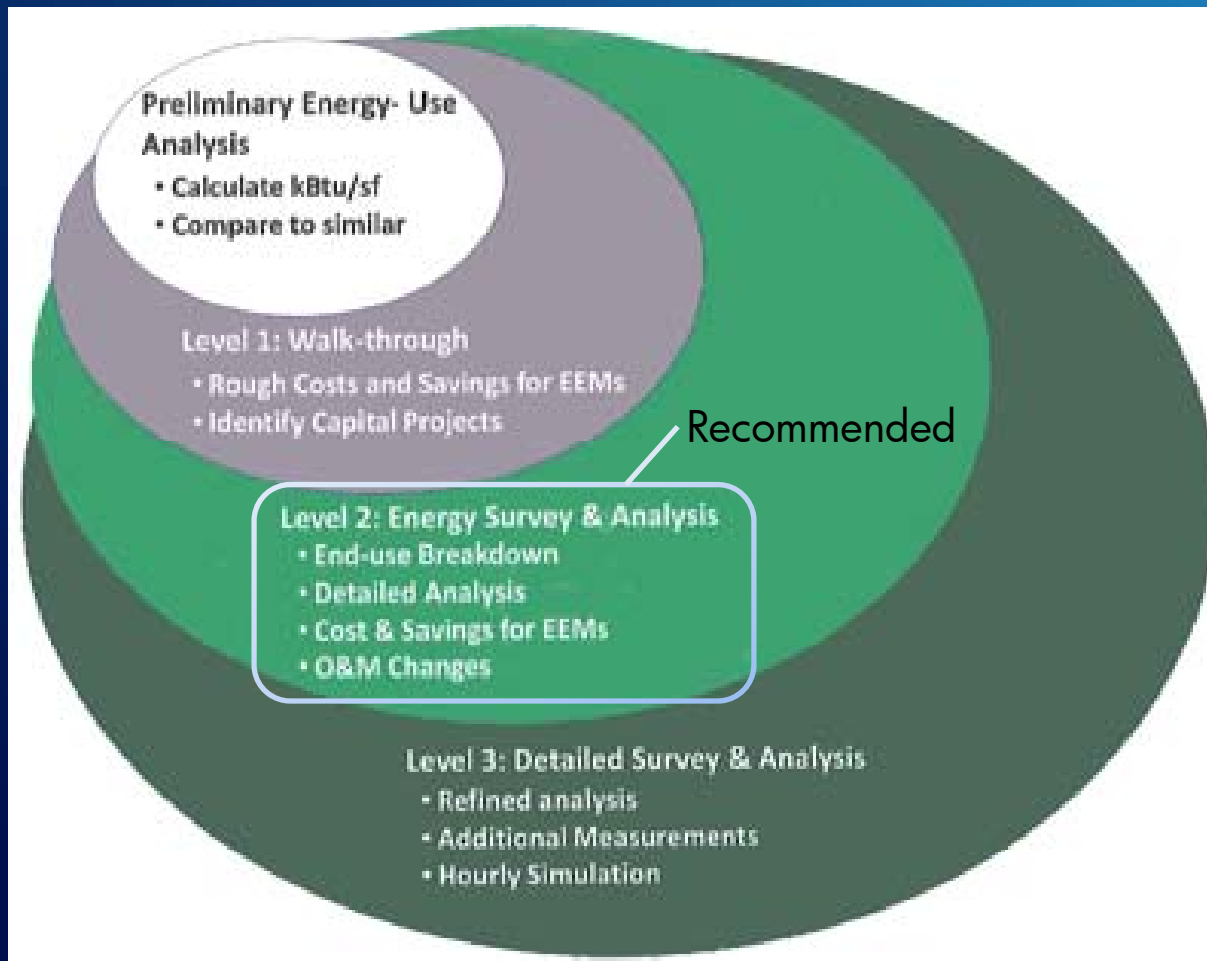
- **Recommended: minimum ASHRAE Level 2 Audit**

- Reviews the building with more detail to develop a clear and concise report that describes a variety of energy conservation measures (ECMs), usually with rankings based on cost to implement
- Allows evaluation of the ECMs and how and when to proceed with implementation
- Some EEMs may be no or low cost; others would need to be further evaluated to determine whether the return-on-investment is feasible

Recommendations

- **ASHRAE Auditing Levels**

- Relationship of Energy Audit Levels 1, 2, & 3 (ASHRAE 2011)



QUESTIONS?

THANK YOU

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